US009636690B2

(12) **United States Patent**
De Lange

(10) **Patent No.: US 9,636,690 B2**
(45) **Date of Patent: May 2, 2017**

(54) **GRAVITY RECOVERY SYSTEM AND METHOD FOR RECOVERY OF HEAVY METALS FROM SANDS AND GRAVELS**

(71) Applicant: **Douglas S. De Lange**, East Grand Rapids, MI (US)

(72) Inventor: **Douglas S. De Lange**, East Grand Rapids, MI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/218,418**

(22) Filed: **Jul. 25, 2016**

(65) **Prior Publication Data**

US 2016/0332167 A1 Nov. 17, 2016

Related U.S. Application Data

(60) Continuation-in-part of application No. 14/794,202, filed on Jul. 8, 2015, now Pat. No. 9,399,225, which (Continued)

(51) **Int. Cl.**
B03C 1/00 (2006.01)
B03C 1/08 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***B03C 1/08*** (2013.01); ***B01D 21/0009*** (2013.01); ***B01D 21/0072*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC B01D 21/0009; B01D 21/0072; B03C 1/0332; B03C 1/0335; B03C 1/228; B03C 1/30
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,700,555 A * 10/1972 Widmark et al. .... G01N 33/491 252/62.51 R
3,892,658 A * 7/1975 Benowitz B03C 1/247 100/91
(Continued)

Primary Examiner — Terrell Matthews
(74) *Attorney, Agent, or Firm* — Kenneth Kohn

(57) **ABSTRACT**

A magnetic field system for producing an interruptible geometrically patterned magnetic field at a surface, including a surface member including a surface, a magnetic member situated exterior to the surface member, including a geometrically patterned array of magnets, the magnetic member being reversibly mounted in sufficient proximity to the surface member to produce a corresponding geometrically patterned magnetic field extending through the surface, the geometrically patterned array of magnets including magnets selected form the group consisting of permanent magnets, electromagnets, and a combination thereof, the geometrically patterned magnetic field being interruptible by the removal of the magnetic member to a location sufficiently distant from the surface member to withdraw the geometrically patterned magnetic field from the surface, or by the depowering of the powered electromagnets. A gravity separation system for separating and recovering metal particles from a liquid stream of suspended particles to be separated. A method for the gravity separation and recovery of metal particles from a liquid stream with a gravity recovery system.

10 Claims, 12 Drawing Sheets